

CA2ALEN40
74V26
C-1

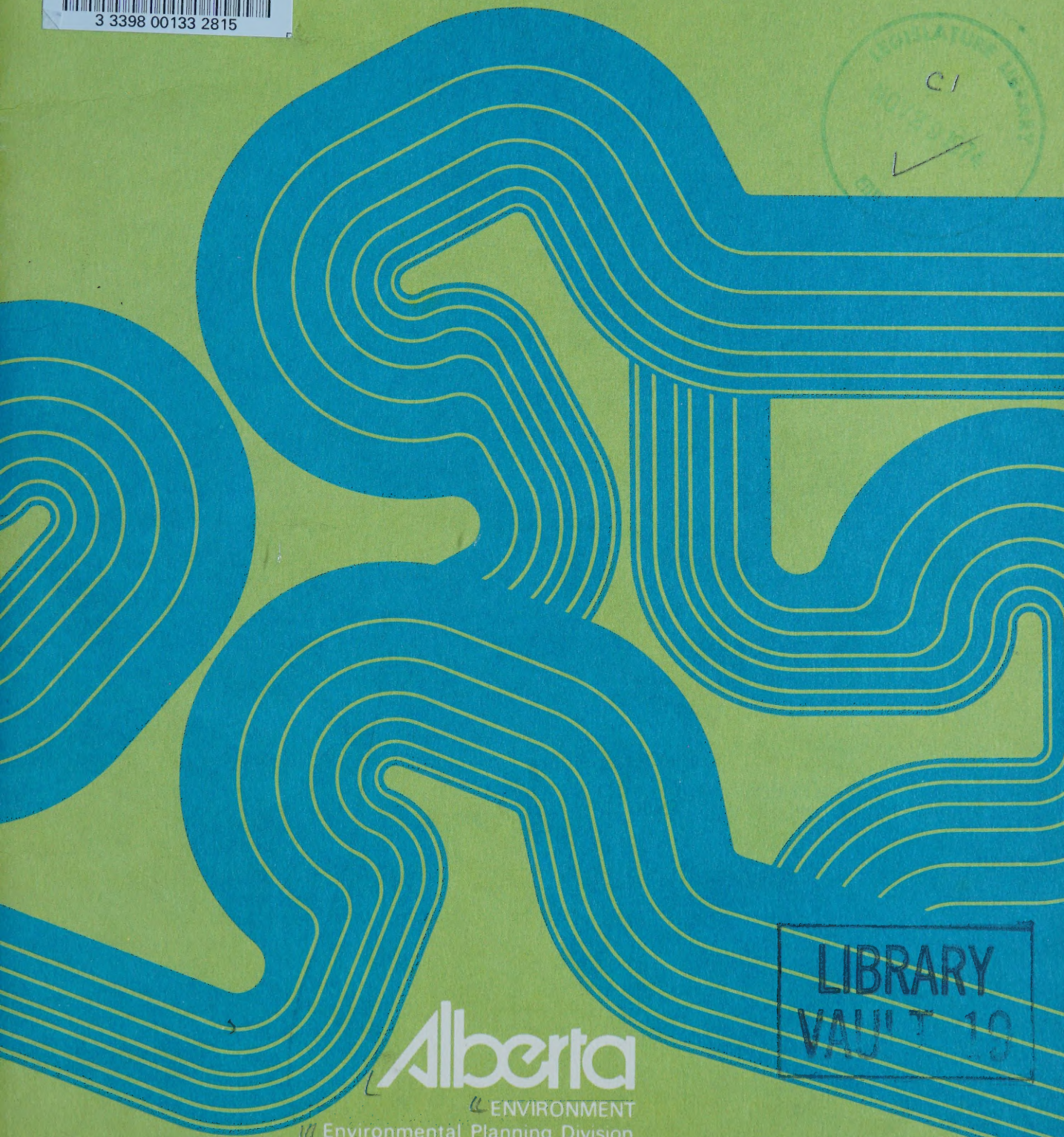
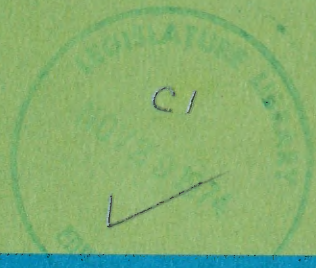
THE VERMILION RIVER BASIN STUDY

A SUMMARY REPORT

CA2 ALEN 40 1974V26
Vermilion River Basin Study: a Summary Report, Nov. 1974.



3 3398 00133 2815



LIBRARY
VAULT 10

Alberta
ENVIRONMENT
Environmental Planning Division

November, 1974

Digitized by the Internet Archive
in 2026 with funding from
Legislative Assembly of Alberta - Alberta Legislature Library

October 30, 1974

THE VERMILION RIVER BASIN STUDY: A SUMMARY REPORT

PREPARED BY: ENVIRONMENTAL PLANNING DIVISION
ALBERTA ENVIRONMENT
OCTOBER, 1974

SUBMITTED BY: T. V. MUSSIVAND

T. V. Mussivand, P. Eng.
Director
Environmental Planning Division

R. E. Bailey, P. Eng.
Assistant Deputy Minister
Environmental Planning and
Research Division



ENVIRONMENT

Environmental Planning Division

403/429-5189

Telex 037-2006 TWX 610-831-2636

10405 - 100th Avenue

Edmonton, Alberta, Canada

T5J 0Z6

October 30, 1974

Hon. W. J. Yurko, P. Eng.
Minister
Department of the Environment

Dear Sir:

We have the pleasure of transmitting *The Vermilion River Basin Study: A Summary Report*. As you are aware, this study was awarded to Reid, Crowther and Partners Limited, an engineering and planning consulting firm, in January 1974, and their recommendations for managing the water resources of the Vermilion Basin are presented.

The purpose of this report is to provide a basis for a basin implementation plan that will relieve flooding of farmlands and municipal facilities, ensure an adequate municipal and agricultural water supply, and preserve or improve the natural capabilities of the basin for wildlife conservation and recreation.

The study has found that a floodway bypass, or sewer modification and dyking, is needed at Vegreville; a control structure is needed near Morecambe to reduce flooding near Two Hills; operational guidelines and upgraded outlet works on the Vermilion Dam are necessary; and municipal and agricultural waste treatment systems are needed in the area.

Major contributors of the report were D. Barton, P. Eng., and J. H. Simpson, P. Eng.

Respectfully yours,

E. E. Ballantyne, D.V.M.
Deputy Minister
Department of the Environment

R. E. Bailey, P. Eng.
Assistant Deputy Minister
Environmental Planning and
Research Service

T. V. Mussivand, P. Eng.
Director
Environmental Planning Division

Attach.

TABLE OF CONTENTS

Page No.

LIST OF FIGURES	iv
I GENERAL INFORMATION	
1. Location and Description of the Basin	1
2. Historical Basin Development	2
3. Objectives, Scope, and Level of the Study	3
II PROBLEMS AND DEMANDS	
1. Agriculture	7
2. Municipal Flooding	10
3. Surface Water Quality	11
4. Water Supply	12
5. Recreation	13
III BASIN MANAGEMENT SCHEMES	14
1. Agricultural Flooding in the Holden Drainage District	14
2. Floodway to Beaverhill Lake	15
3. Municipal Flooding at Vegreville	16
4. Agricultural Flooding Near Two Hills	17
5. Vermilion Dam and Reservoir	19
6. Agricultural Flooding Near Vermilion	19
7. Waste Treatment	20
IV RECOMMENDATIONS	21

LIST OF FIGURES
(Following Page 23)

- FIGURE 1 STUDY AREA LOCATION PLAN
- FIGURE 2 KEY BASIN PLAN RECOMMENDATIONS
- FIGURE 3 POTENTIAL SOLUTIONS FOR TOWN OF VEGREVILLE FLOODING
- FIGURE 4 PROPOSED FLOOD RELIEF MEASURES FOR THE TWO HILLS
FLOODPLAIN
- FIGURE 5 LOCATION PLAN OF VERMILION FLOODPLAIN AREA

I GENERAL INFORMATION

1. Location and Description of the Basin

The Vermilion River flows in a generally easterly direction and drains an area of approximately 2,900 square miles. It is about 200 miles long and has a total drop of about 600 feet. The Vermilion joins the North Saskatchewan River at Lea Park, about 15 miles west of the Alberta-Saskatchewan border (see Figure 1).

Agriculture (cattle, hogs, and grain) is the main industry in the basin; about one half of the basin population of 22,000 (1971) is rural. The remaining 11,000 people live in four towns and several small villages scattered throughout the basin. Vegreville, Vermilion, and Two Hills are the largest towns in the area, having populations (1971) of approximately 3,700, 2,900, and 1,000. These three towns are located directly on the Vermilion River.

As Figure 2 shows, the basin is irregularly shaped, narrowing near the Town of Vermilion. The river's gradient also varies. Although the river drops an average of three feet per mile, in any particular reach the drop may be six or eight feet, or it may be zero. The Two Hills and Vermilion floodplain areas, for example, and the Holden Drainage District, have extremely low gradients. Also, the reaches of river at, and below, the Town of Vegreville and above the Village of Mannville are relatively flat.

Generally speaking, the channel carrying capacity varies with the river gradient. Observed bankfull capacities of about 800 cubic feet per second in the steeper reaches diminish to about 300 cubic feet per second in the floodplain areas.

2. Historical Basin Development

Flooding and drainage in the basin have been problems since it was settled, at the turn of the century. Information and correspondence on flooding near Two Hills dates back to 1904. In the early 1920's about 38 miles of channel were constructed, to improve drainage in the Vermilion River's headwater area south and southwest of Bruce.

For the past 50 years, the drainage capacity of the Holden Drainage District has been reduced by erosion, siltation, vegetation regrowth, and trampling by livestock. A program of general upgrading for this district was begun in 1973.

Canadian Utilities (Alberta Power) in cooperation with Ducks Unlimited constructed a gated dam near Morecambe, at the outlet of the Vermilion chain of lakes, in 1950. This structure had two purposes: to store cooling water for the thermal plant at Vermilion and to improve waterfowl habitat upstream. This dam, however, was never licensed. Many upstream farmers complained of increased flooding and siltation; this resulted in the removal of stoplogs and centre piers, by order of a government arbitration committee in 1955, and in 1973 the remaining sill and abutments of the Morecambe structure were removed by the Department of the Environment.

In 1952 a dam was built on the Vermilion River near the Town of Vermilion. This created a reservoir intended to have six uses: municipal water supply, provincial park facilities, cooling water for a Canadian Utilities power plant, CNR water supply, fish and wildlife conservation, and downstream flow regulation. Several of these uses, however, no longer apply. The Town of Vermilion now gets its water from wells near the reservoir; the power plant has been inoperative since 1965; CNR no longer

needs water for steam locomotives. Present reservoir use is restricted mainly to recreation associated with the provincial park facilities.

Attendance at Vermilion Provincial Park has grown steadily, with an increase in user days from about 50,000 in 1960 to about 200,000 in 1972. This park is an important one. Of the 44 provincial parks, it ranks seventh, and accounts for about 4% of total provincial use. Presumably, the reservoir has helped account for the popularity of the Vermilion Park; the lack of dam operation criteria has, however, been criticized by downstream floodplain residents.

The above paragraphs outline the major pertinent developments in the basin. There are a number of other activities which influence flooding, for better or worse. Speaking generally, agricultural clearing, on-farm ditching, and draining sloughs increase the basin's runoff capacity; on the other hand, road and bridge construction tends to reduce the river's discharge capacity.

3. Objectives, Scope, and Level of the Study

Prompted by flooding problems in 1971, 1972, and 1973, and by growing concern over the water quality of the Vermilion River, the Department of the Environment carried out a short-term reconnaissance study in 1973, to identify and define problem areas in the basin. The major finding of this brief study was that more studies were needed: there was a lack of physical data on which to base recommendations for potential solutions to identified problems.

In the fall of 1973, therefore, the Department of the Environment invited proposals for a comprehensive basin study. In January of 1974 the study was awarded to Reid, Crowther and Partners Limited, a Calgary-based engineering and planning consulting firm. The report which they

submitted in fulfillment of their contract has been condensed into this present summary report.

The Consultant was requested to provide recommendations for management of the water resources of the Vermilion basin, to provide relief from the flooding of farmlands and municipal facilities, to ensure an adequate municipal and agricultural water supply, and to preserve or improve the basin's natural capabilities for wildlife conservation and recreation.

Accordingly, two major field studies were conducted, during which hydrological and biological data were gathered. This information was used for problem definition and solution analysis, and was incorporated into the consultant's report, which was finished in October of this year, and will be published as a technical appendix to this one. Their report includes identification of problems and demands, formulation of alternatives, evaluation of alternatives, and recommendations for management or development. The level of technical and economic analysis provides a basis for informed decisions and choices, among development alternatives.

The study was conducted under these nine general terms of reference:

1. Define the hydrological characteristics of the Vermilion River basin to the extent necessary to understand the flooding phenomena and to allow evaluation of the physical effectiveness of solutions which may be proposed. The need for additional survey or monitoring of flow or lake levels should be established as early in the study as practical in order that the Department may judge whether these activities will be carried out by Department staff or contracted for.
2. Extend the economic analysis of the flooding problem which has been carried out to provide a broad regional assessment of the problems.

3. Identify the extent of present and projected municipal, industrial and agricultural water supply deficiencies in the basin.
4. Identify industrial, municipal or agricultural effluent sources which limit the utility of the water course for other purposes.
5. Identify the capability and potential for fish and wildlife conservation and enhancement in the basin. It is anticipated that a study presently being carried out by Ducks Unlimited will provide substantial input to this activity.
6. Review the present operating procedures of the Vermilion Dam in terms of recreation use and the conflict with downstream land owners and outline the desirable operating features which should be incorporated into either (a) a rehabilitation of the existing structure or, if a separate study indicates the desirability of replacing the structure, (b) design of a replacement structure.
7. Formulate and analyse alternative engineering and/or management solutions to the problems and demands identified in the basin. Measures to resolve flooding problems in the Two Hills area should be emphasized. The alternatives should include, but not be limited to those outlined in the Phase I report. In particular, analysis should include:
 - (i) Diversion from the upper portion of the basin to the Beaverhill Lake.
 - (ii) Removal of the Morecambe rapids and associated channel modifications, and control structures.
 - (iii) Provision of storage reservoirs in the upper portions of the basin.

8. Evaluation of the various alternatives in terms of physical, economic, and social aspects and recommendations of an integrated plan to meet the needs of the basin.
9. Preparation of a report incorporating the results of the study.

II PROBLEMS AND DEMANDS

1. Agriculture

The four identified agricultural problems in the Vermilion Basin are: flood damage to native hay, flood damage to unharvested crops, erosion and siltation, and excess salinity in certain areas.

A 1973 Alberta Environment questionnaire constituted the main source of information on flood damage along the river; additional data on agricultural problems were obtained by the Consultant through field observations and discussions with local farmers.

This information indicated that damage to native hay is the primary agricultural flood problem. Hay flats near Two Hills and the Town of Vermilion are usually flooded annually, in the spring. About 4,000 acres are subject to flooding in the Two Hills floodplain; less than 2,000 in the Vermilion floodplain. For both these areas the number of acres covered by water is about the same each year, and the scale of runoff determines the depth of floodplain inundation. It is therefore not peak flood flows but rather runoff volume that determines the degree of damage potential in a particular year.

Normally, it is the lingering spring flood which causes damage in these two floodplain areas. In about 13 years of recorded discharge in the basin, distinct summer flooding has occurred only twice: in 1965, a large spring flood was followed by a large summer flood; in 1973, spring runoff was moderate but summer flooding, caused by high rainfalls in late June and early July, was extensive.

1972 FLOOD CHARACTERISTICS

FLOODPLAIN NEAR	ACRES FLOODED IN SPRING	ACRES STILL FLOODED ON			
		JUNE 1	JULY 1	AUGUST 1	SEPTEMBER 1
TWO HILLS	3992	3895	3612	2743	2701
MANNVILLE	685	170	30	30	30
VERMILION	1738	820	522	237	237

The above table indicates that not only are there different areas subject to inundation near Two Hills, Mannville, and Vermilion, but that the rates of runoff vary widely in these three floodplains. For example, at Mannville and Vermilion the area which remains flooded by June 1 is less than half of that initially covered. By contrast, the area covered at Two Hills on June 1 remains at about 98% of the area flooded in the spring. By July 1, flooding has nearly left the Mannville area; the Vermilion area remains about one-third covered; the Two Hills floodplain (chiefly the region upstream from Two Hills) remains 91% flooded.

To assess the relative flood damage in each of these floodplain areas, the following time-damage function was assumed for native hay (over 95% of the agricultural flood damage in the basin is to this crop):

1. Land drained by July 1 equals no damage to native hay;
2. Land drained by August 1 equals 50% loss of native hay crop;
3. Land still inundated by September 1 represents a 100% loss.

Using this guideline, the loss of native hay from the 1972 flood near Two Hills, Vermilion, and Mannville is seen to approximate 3,000 acres, 300 acres, and 30 acres, respectively.

The Two Hills floodplain area is about 20 miles long, and is characterized by a chain of eight lakes. The river slope through this

chain is extremely low, less than an inch per mile during high flows and ice conditions. The lakes are numbered from Lake 1, at the outlet, to Lake 5, which is adjacent to Two Hills. Lake 6 is upstream of Two Hills and leads into Bens Lake and Watt Lake. In the lower reaches of the floodplain, the interconnecting lake channels are well-defined but small; between Watt Lake, Bens Lake, and Lake 6 the interconnecting channels are not defined, are extremely small, and overgrown with vegetation.

The hydrology survey program indicated that the backwater effect in the Two Hills floodplain is caused by a combination of several factors: lack of slope, size of interconnecting channels, and inadequate bridge openings and outlet capacity near Morecambe. The main controlling feature of the outlet of this chain of lakes is a series of rock rapids just downstream of the outlet. (The abandoned road grade at Morecambe also has a controlling influence at high flows.)

Flooding downstream of the Vermilion Dam also results from lack of slope and inadequate channel capacity. Although a program was developed, within the study framework, to survey the floodplain at Vermilion, the 1974 flooding made these investigations impossible.

A wet fall in 1973 resulted in an estimated 20% of the total cultivated acreage in the basin remaining unharvested. Although a portion of this unharvested crop was salvaged the following year, the 1974 flooding was large enough to impede salvage operations and thus increase 1973 crop losses. It should be pointed out that the flood management schemes outlined in this report pertain chiefly to native hay-intensive floodplain areas, which are far less subject to problems carried over from the fall of one year to the spring of the next.

The two remaining agricultural problems in the area (erosion and siltation, and excessive soil salinity) are less dramatic than flood-damaged crops, but they are persistent and troublesome.

Observations of the 1974 flood indicated some land loss through erosion and excess siltation, mostly on summerfallowed cultivated lands. The consequences of this type of damage are relatively long-term, compared with the immediate flood damage to crops.

Finally, there are approximately 800 square miles of saline solonetz soil in the basin above Two Hills. Good drainage is essential to the productivity of such soils.

2. Municipal Flooding

Municipal flooding occurs less frequently than agricultural flooding, but the potential for damage to the towns is significant. Although Two Hills sustains some damage during extremely high flows, municipal flooding problems in the basin are concentrated at Vegreville, where floods were documented five times in the past 35 years--1940, 1943, 1948, 1956, and 1974.

Alberta Disaster Services Agency provided the only available data on municipal and hospital damages caused by the 1974 flood. This Agency assessed damages to the town at about \$100,000 to \$150,000. The actual cost of damages, however, may far exceed this rough figure, because certain items were excluded (in accordance with Disaster Services regulations), and because the appraisal system did not quantify donations of time, material, and equipment by the community, private organizations, and the Government.

About 80 home owners were affected by this flood, which also necessitated the evacuation of 89 geriatric and paraplegic patients from Vegreville hospitals. Floodwaters entered the Town's sanitary sewer system and

caused them to back up. This was the major cause of damage to private homes and the prime reason for the hospital evacuation. The sewer problem was aggravated by an unfortunate coincidence: nearby roads were being reconstructed, and unfinished manholes were fitted with temporary covers. Thus, floodwaters entered the sewer system at a lower elevation than they otherwise would have, had the final grades been completed. Total damage to roads and bridges in the basin from the 1974 flood is estimated at more than \$1 million.

3. Surface Water Quality

The 1974 biological field investigation program disclosed a number of conditions which indicate a general poor quality of river water. Large fluctuations in water level, low summer and winter flows, ice cover, high turbidity, and high summer water temperatures are some natural causes of this poor water quality. Municipal and agricultural wastes also have an adverse effect on the river system.

By all the usual biological criteria, the Vermilion reservoir is in poor condition. It is a natural sink for nutrients and organic materials discharged into the river. Nutrients tend to accumulate in the lakes and reservoirs of the river system, and this accumulation is not a specific function of discharge patterns. Timing of discharge, however, is critical to conditions in the flowing sections of the river.

The most sensitive period occurs in winter, when flows are low and the river is covered with ice. Nearly as crucial are the periods of summer low flow and high water temperatures.

Municipal and agricultural waste runoff to the river have about the same adverse effect on water quality. Water quality is generally better upstream from Vegreville and near the mouth of the Vermilion River, and poorer in between. In general, water quality is better immediately upstream from waste discharges.

Feedlot wastes are the most serious agricultural pollutant to the river, although the effect of high strength agricultural waste discharges in the spring is somewhat mitigated by high spring flows and natural aeration.

Vermilion, Vegreville, and Two Hills contribute continuously or occasionally, in varying amounts, to waste loading in the river. The net effect is year-round waste loading, with peak load during the winter. Studies are presently being conducted by each of these municipalities, to upgrade waste treatment facilities in compliance with Department of Environment standards.

4. Water Supply

Present water supply, for the municipalities in the basin, is adequate. Studies are currently in progress by the Towns of Vegreville and Vermilion, for the purpose of expanding existing systems to meet expected increased demands in the future. Vegreville is the only town in the basin which relies on surface water for its municipal supply. There is limited data on the maximum capacity of well systems for the other municipalities; increased future demands could, possibly, be met by augmenting these wells with surface water.

5. Recreation

The Vermilion Provincial Park covers about 1,800 acres near the Town of Vermilion. This park has facilities for water-oriented sports, picnicking and camping. Four other provincial parks and the federal Elk Island Park are within a day's drive from the basin.

Vermilion basin provides opportunities for hunting, fishing, wildlife observation, and canoeing. Waterfowl is the most important wildlife resource in the basin. There is excellent waterfowl habitat for breeding birds, and there are major staging areas during fall migration. Thus, waterfowl hunting is excellent.

Game hunting is limited by lack of suitable habitat, and sport fishing in the basin is limited by adverse environmental factors. Some lakes, however, such as Jackfish Lake, have been stocked.

To sum up: The Vermilion basin provides diverse recreational opportunities for the residents of the area which, in proportion to its population base, compared favorably with other areas of the province.

III BASIN MANAGEMENT SCHEMES

Various alternative solutions have been assessed for identified problems and demands in the basin. The purpose of this chapter is to outline the various concepts considered, summarize supporting rationale, and recommend a framework plan for basin development. The level of analysis is sufficient to permit selection of a basic development framework; it must be pointed out, however, that refinement of a favored alternative is necessary, to answer specific technical, economic, and ecological questions.

The following discussion of management concepts begins at the headwater reaches of the Vermilion River and works progressively downstream; this format accommodates a continuing discussion of downstream effects of various schemes.

1. Agricultural Flooding in the Holden Drainage District

The ditch system of the Holden Drainage District has deteriorated. A major reconstruction scheme to establish a design outflow capacity of 750 cubic feet per second (cfs), has been considered by the Department of the Environment. Alternately, a program of upgrading, and removing local control points and obstructions was begun in 1973. Existing bankfull channel capacities between Bruce and Vegreville are not presently adequate to handle outflows from a major reconstruction of the drainage district, but downstream channel capacities are generally adequate to handle the somewhat improved outflows from the general upgrading program.

The cost of a major reconstruction program is estimated at \$600,000. About \$20,000 were spent in 1973 on general improvements to the Holden Drainage District; fall 1974 improvements are estimated at \$24,000.

2. Floodway to Beaverhill Lake

The concept of diverting excess floodwaters from the Vermilion basin headwaters to Beaverhill Lake resulted primarily from concern that a major reconstruction of the Holden Drainage District would worsen downstream flooding problems. Diversion of floodwaters from the vicinity of Bruce to Beaverhill Lake would require a channel about 28 miles long, costing an estimated \$6 million. Given a 300 foot right of way for the channel, implementation of this scheme would remove about 1,000 acres of mostly cultivated land from production. This project would be operated only during peak flood flows, to ensure that downstream surface water supplies for Vegreville remain adequate.

The possibility of diverting water from the headwaters of the Vermilion River, as a means of flow augmentation for lakes in the Cooking Lake area, has been considered. According to this scheme Beaverhill Lake would function as an intermediate holding reservoir. Analysis of past discharge records, however, shows that in the past 13 years such a floodway would have been used only five times, and that the floodwaters diverted in these five years would have varied widely in volumes, from about 1,000 acre-feet to about 49,000 acre-feet (1974). Thus, diversion of Vermilion headwaters would not supply a reliable source of water for Cooking Lake area augmentation, or any other use.

Furthermore, the consequences of diverting floodwaters to Beaverhill Lake have not been assessed; such an assessment would be part of the Cooking Lake area study, should this concept be pursued. Although diversion of floodwaters to Beaverhill Lake would offer a degree of flood relief to Vegreville and the farms below it, the importance of such a diversion project would be markedly reduced, should a decision be made to provide local flood protection at Vegreville.

3. Municipal Flooding at Vegreville

The possibility of developing reservoir flood storage upstream from Vegreville has been studied, but no storage sites of sufficient size were identified. The 1974 flood volume above the Vermilion River's capacity was roughly 30-35,000 acre-feet. Thus, the storage capacity of the potential Waskwei Creek damsite, about 1,100 acre-feet, would have no significant effect on Vermilion River flood control. Such a reservoir could, however, be used for recreation, and storage of additional runoff from upstream drainage improvements and of water for the Town of Vegreville.

Peak 1974 discharge at Vegreville was 2,800 cfs; existing river channel capacity is only about 800 cfs. The proposed Vegreville floodway bypass would protect against the 1974 level of flooding, a flood that is estimated to recur on an average of once in 50 years. (See Figure 3).

Such a channel, in conjunction with natural river capacity through the town, would provide flood control to the one in 50 year level. Although the estimated development cost of \$2 million appears to be well in excess of quantified benefits, eliminating the necessity of hospital evacuations is an important, unquantifiable consideration.

By canceling natural flood storage at Vegreville, the floodway bypass would slightly increase discharges below the town. It is estimated from 1974 aerial photography that about 2,000 acres of farmland were flooded, between Vegreville and the confluence of Vermilion River and Spring Creek above Bens Lake. Natural peak discharge below Vegreville in 1974 was about 2,400 cfs; a floodway bypass would have increased this by about 15%, to somewhat more than 2,700. Thus, it is unlikely that such a proposed bypass would contribute significantly to downstream flooding during large floods.

Development of a structure to control division of flow between the natural river channel and the bypass would cost an estimated \$300,000. (The need for such a controllable structure, as opposed to a natural flow division, should be established in the predesign stage.) No adverse environmental effects are expected with this scheme provided that the floodway is designed to drain after operation.

In 1974, Vegreville flood damage was largely caused by the backing up of sanitary sewers, which was caused, in turn, by floodwaters entering the sewer system. This problem was compounded by road flooding, which made access difficult. These facts suggest that modification of Vegreville's utilities systems might be an alternative to the bypass, and this alternative has been considered. The cost of associated river channel modification (including dyking), roadway and bridge modifications, and modifications to the sewer system, is an estimated \$650,000--about one-third that of a floodway. The technical problems associated with Vegreville utility modifications, however, could well be much greater than the problems involved in a floodway scheme. A more detailed investigation is necessary, to assess the feasibility of the utility modification concept, and this investigation should be conducted during floodway predesign.

4. Agricultural Flooding Near Two Hills

Various flood damage reduction schemes for the Two Hills floodplain area have been studied. One possibility considered was the construction of a dam on the Vermilion River just below Spring Creek and above the floodplain. This development would create 6,000 to 8,000 acre-feet of flood storage, and would inundate approximately 600 acres of farmland. The dam would be a barrier to fish, and any pike currently spawning in the Bens, Watt and Vermilion Lakes area would be cut off from the upstream reaches of the Vermilion River. Also, the rapid changes in reservoir water level would

affect marginal vegetation adversely; the damage to marginal vegetation would, in turn, do the ungulate population no good. Therefore, the relatively small storage capacity, the environmental cost, and the area of agricultural land which would be removed from production, indicate that a dam and reservoir below Spring Creek would not be the best solution to flooding in the Two Hills floodplain.

Another concept, that of diverting flood waters from the Two Hills area to the North Saskatchewan River, has received attention. Each of three alternate floodways for this scheme would cost an estimated \$10 million. A floodway bypass south of the floodplain has also been considered; its cost is estimated at \$6 million. Because all these floodways would be quite long, it would be necessary to buy large amounts of agricultural land; for this reason, primarily, these floodways are not considered a practical means of flood reduction in this area.

A third scheme appears to be more promising than the previous two. This calls for improving the outlet of Lake 1 near Morecambe to increase floodplain discharge capacity. Development of a control structure at the floodplain outlet near Morecambe, with associated works to downstream rapids and upstream control points through the floodplain, provides the most feasible measure to reduce flooding and damage to native hay along the chain of Vermilion lakes. (See Figure 4).

Because the floodplain is flat, it is difficult to specify the exact combination of technical improvements required throughout the area, to achieve a compatible flood reduction system. For this reason, the control structure should be designed and built with associated improvements to downstream rapids, and the characteristics of upstream controls should be observed over a wide range of flow conditions to provide information

on necessary channel and bridge modifications along the floodplain.

Finally, the predesign of a floodplain outlet structure must be carefully done, to prevent increased downstream flooding.

It is important to recognize that this scheme would not provide total flood protection. The floodplain purchase-leaseback concept may, therefore, be applicable to those floodplain residents not likely to benefit much from the proposed flood reduction development.

5. Vermilion Dam and Reservoir

The Vermilion Reservoir's prime capability is for water-based recreation; it cannot provide any significant downstream flood protection.

Further, the present stoplog arrangement is difficult to operate (there was fear that the dam would be overtopped during the 1974 flood), and it would be advisable that operational and safety improvements be made. Installation of a stoplog hoist, for example, or replacing the stoplogs with a gated structure, should be carried out. An emergency spillway is required for present outlet capacity. Dam operation criteria should be specified, for best recreational use of the reservoir and to ensure that dam operation does not create or worsen flooding in the vulnerable downstream reaches. A flood warning system should be incorporated into dam operation regulations, and the Department of the Environment should be responsible for regulating dam release. Finally, it would be advisable to isolate beach and swimming areas (and control water quality in these areas) from the main reservoir, which would be used for boating, fishing and so forth. (See Figure 5).

6. Agricultural Flooding Near Vermilion

No feasible measures have as yet been identified, to reduce flooding and resultant native hay damage in the Vermilion floodplain. A conceptual

upstream diversion to the Grizzly River in the Battle River system is neither economically nor environmentally justifiable.

The 1974 flood precluded a planned survey of the river and floodplain below the Vermilion Dam. The Department of the Environment has, however, now begun detailed investigations of this reach, to determine the feasibility of channel modifications and removal of controls in the area as means of providing flood relief.

7. Waste Treatment

As was mentioned earlier, municipal and agricultural wastes account about equally for the Vermilion River's poor water quality. It is recommended that aerobic-anaerobic lagoon systems, with a minimum of 12 months lagoon detention, be incorporated into the treatment systems of Vermilion, Two Hills, and Vegreville. Since it is very difficult to pinpoint animal waste effluent locations along the river, an economic study of on-farm agricultural waste treatment should be conducted. The purpose of the study would be to determine the impact on various farming operations of livestock waste treatment. It is recommended that the guidelines for confinement livestock waste management, developed jointly by the provincial Departments of Agriculture and the Environment, be applied in the basin.

It is further suggested that waste treatment lagoons be provided for feedlots in excess of 1,000 head, and that spray irrigation disposal of liquid wastes be investigated in detail.

IV RECOMMENDATIONS

1. A program of general upgrading of the Holden Drainage District, as commenced in 1973, can be pursued without adverse downstream effects, but detailed investigation of downstream effects should precede any decision toward major reconstruction of the Holden Drainage District, and further consideration of a major scheme should incorporate appropriate measures to offset identified downstream problems.
2. Diversion of floodwaters to Beaverhill Lake is not a viable scheme from a Vermilion basin standpoint, especially if a decision is made to implement flood control measures at Vegreville. Findings on this subject should be transmitted to Cooking Lake Area Study personnel.
3. A dam on Waskwei Creek is not recommended for flood control at Vegreville and downstream. However, a reservoir may have application for recreation and water supply storage for the Town of Vegreville, and for flood management within the Waskwei Creek sub-basin, in conjunction with upstream drainage improvements.
4. Preliminary design should be initiated as soon as possible for the Vegreville floodway.
5. Detailed investigation of Vegreville flood protection through modification of the sanitary sewer system and associated dyking should be conducted during the floodway design stage, at the end of which an implementation decision can be made between this alternative and floodway construction.
6. A control structure at Morecambe at the outlet of the Vermilion chain of lakes is considered the prime component of a scheme to

reduce flood problems in the Two Hills floodplain, and preliminary design should be undertaken. Controls are identified throughout the floodplain, and discharge capacity at these points must be compatible with an improved outlet. The effects of flow obstructions through the chain of lakes should be investigated to determine further incremental benefits to the weir scheme. Potential downstream problems created by improvements in the Two Hills floodplain must be further defined and strategies developed to offset them should they prove significant.

7. Removal of the old road grade near Morecambe at the outlet of Lake 1 is considered an interim flood relief measure until weir predesign studies are completed. This scheme is recommended for construction in the fall of 1974.
8. A scheme involving development of a flood control dam on the Vermilion River below Spring Creek should be rejected as a possible project for alleviating flood problems in the Two Hills area.
9. Major floodway schemes in the Two Hills area, to divert peak flows to the North Saskatchewan River or around the floodplain, should not be considered viable projects for resolving flood problems.
10. Floodplain purchase-leaseback should be considered as an alternative for farmers situated in those areas of the Two Hills floodplain which may not receive substantial flood reduction benefits from a weir scheme.
11. A potential diversion of floodwaters from the Vermilion Basin to the Grizzly River should be rejected as a potential management alternative.
12. The concept of isolating a swimming and beach area within the Vermilion reservoir, with controlled water quality, should be incorporated into plans to upgrade the Vermilion Provincial Park.

13. It is recommended that safety and operational improvements be made to the Vermilion Dam. Installation of a stoplog hoist or replacement of stoplogs by a gated structure should be carried out. An emergency spillway is required for present outlet capacity. Present summer operating levels should be maintained for recreational use of the reservoir, and the outlet should not be operated in a manner which will create or aggravate overbank flooding in downstream areas. The Department of Environment should be responsible for control of dam operation.
14. Investigation of the Vermilion floodplain should be carried out during low flow conditions to ascertain potential application of channel improvements and removal of controls for flood relief in this area.
15. Waste treatment at Vegreville, Two Hills and Vermilion should be upgraded to anaerobic-aerobic lagoons with a minimum of twelve months storage.
16. Treatment lagoons should be provided for feedlots in excess of 1,000 head. Spray irrigation disposal of liquid wastes should be investigated in detail. An economic study of agricultural waste treatment should be conducted prior to finalizing decisions on livestock waste treatment.
17. The Department of Agriculture should encourage farmers to follow established guidelines for management of livestock wastes.
18. The Department of Agriculture should advocate the concept of reduced summerfallowing practices to basin farmers.

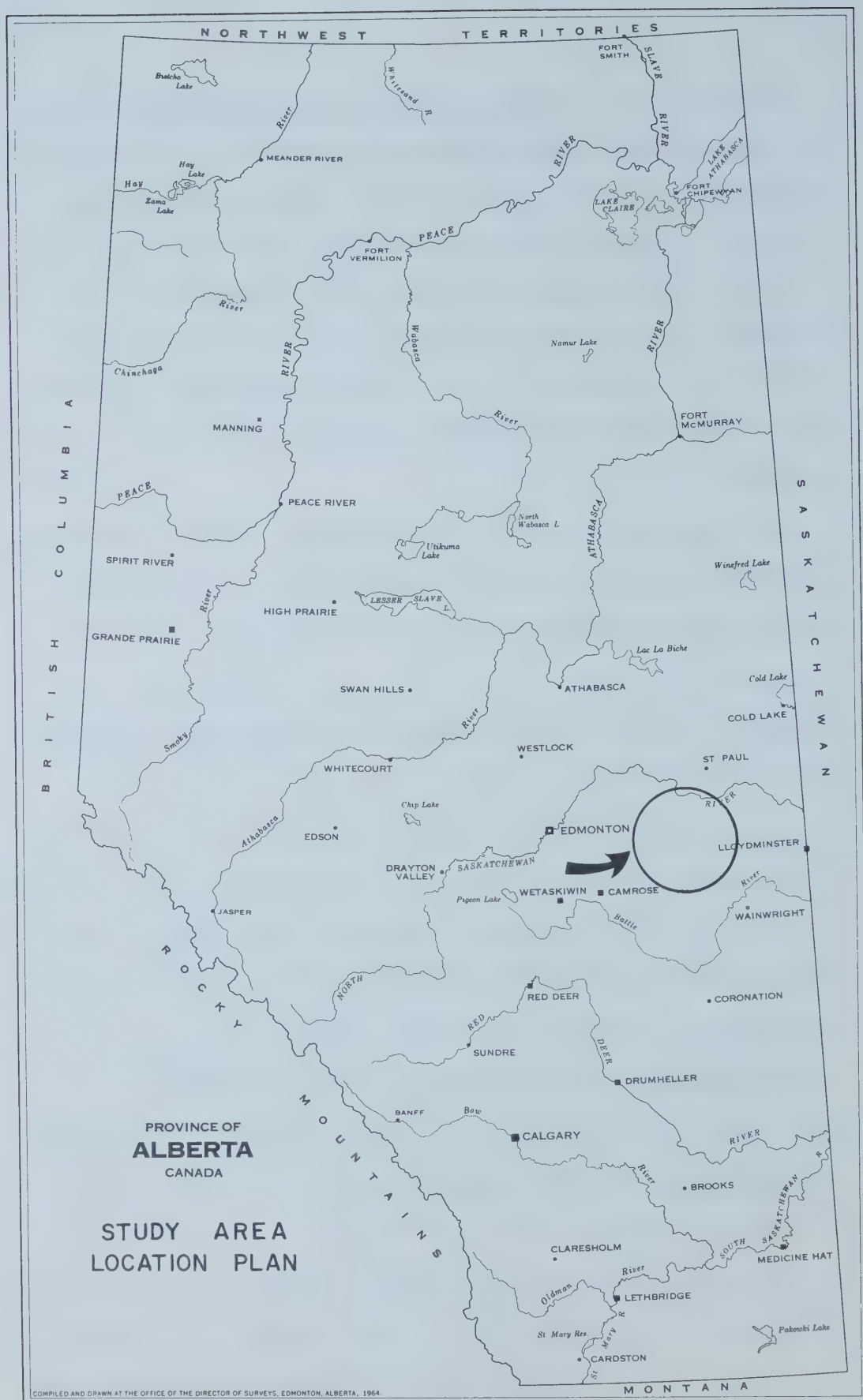


FIGURE 1

MUNICIPAL FLOODING AT VEGREVILLE

Undertake predesign for two alternative flood control measures:
Floodway bypass or Sanitary sewer modification / dyking.

AGRICULTURAL FLOODING NEAR TWO HILLS

Finalise predesign of control structure at outlet of lake chain, incorporating necessary upstream and downstream improvements.

Consider removal of abandoned road grade at Lake 1 outlet as an interim flood control measure.

AGRICULTURAL WASTE TREATMENT

Conduct study on economic impact of waste treatment for feedlot operations and determine feasible controls.

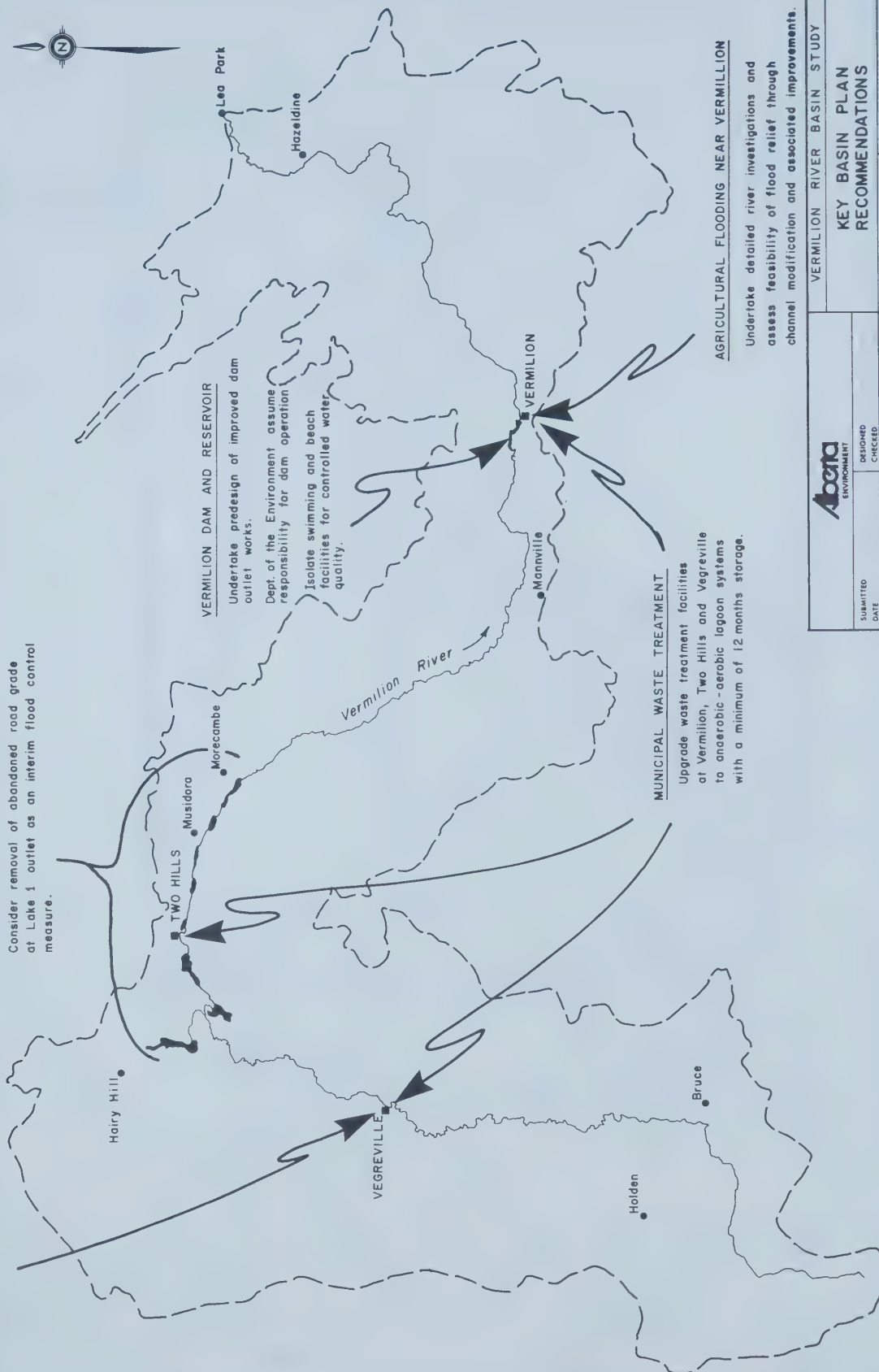


FIGURE 2

Abeta
ENVIRONMENT

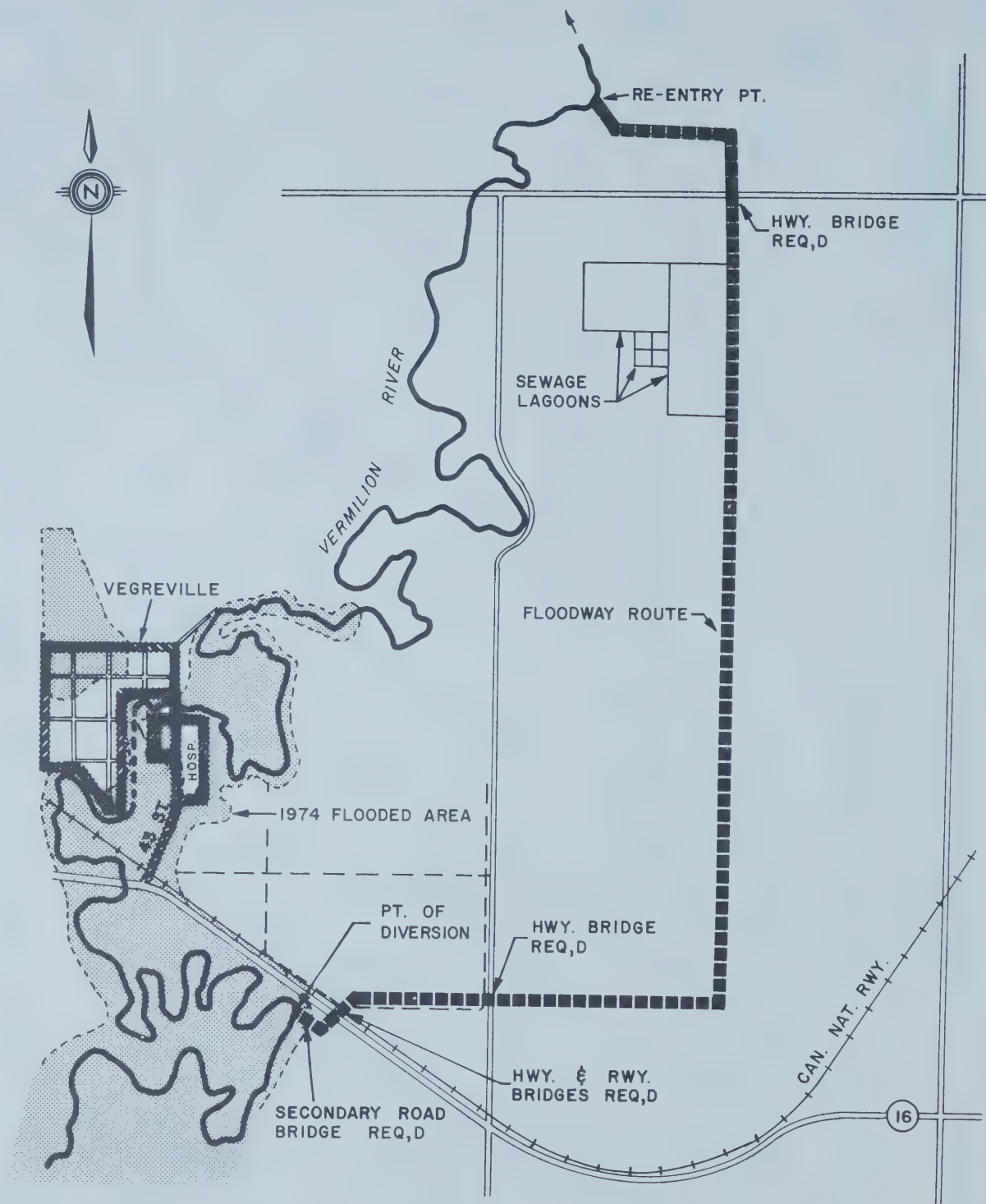
SUBMITTED	DESIGNED	CHECKED	DRAWN	TRACED
DATE	DATE	DATE	DATE	DATE

KEY BASIN PLAN RECOMMENDATIONS

VERMILION RIVER BASIN STUDY

SCALE
DATE OCT. 1974
SHEET 1 OF 2
PLATE NO. 2

5 4 3 2 1 0 4 5



- DYKING
 - CHANNEL MODIFICATION

FIGURE 3

Alberta
ENVIRONMENT

VERMILION RIVER BASIN STUDY

POTENTIAL SOLUTIONS FOR TOWN OF VEGREVILLE FLOODING

SUBMITTED
DATE

DESIGNED
CHECKED

APPROVED
DATE

DRAWN M. McQUITTY
TRACED

SCALE 1" = 1000'

DATE OCTOBER, 1974

SHEET OF

PLATE No. 3

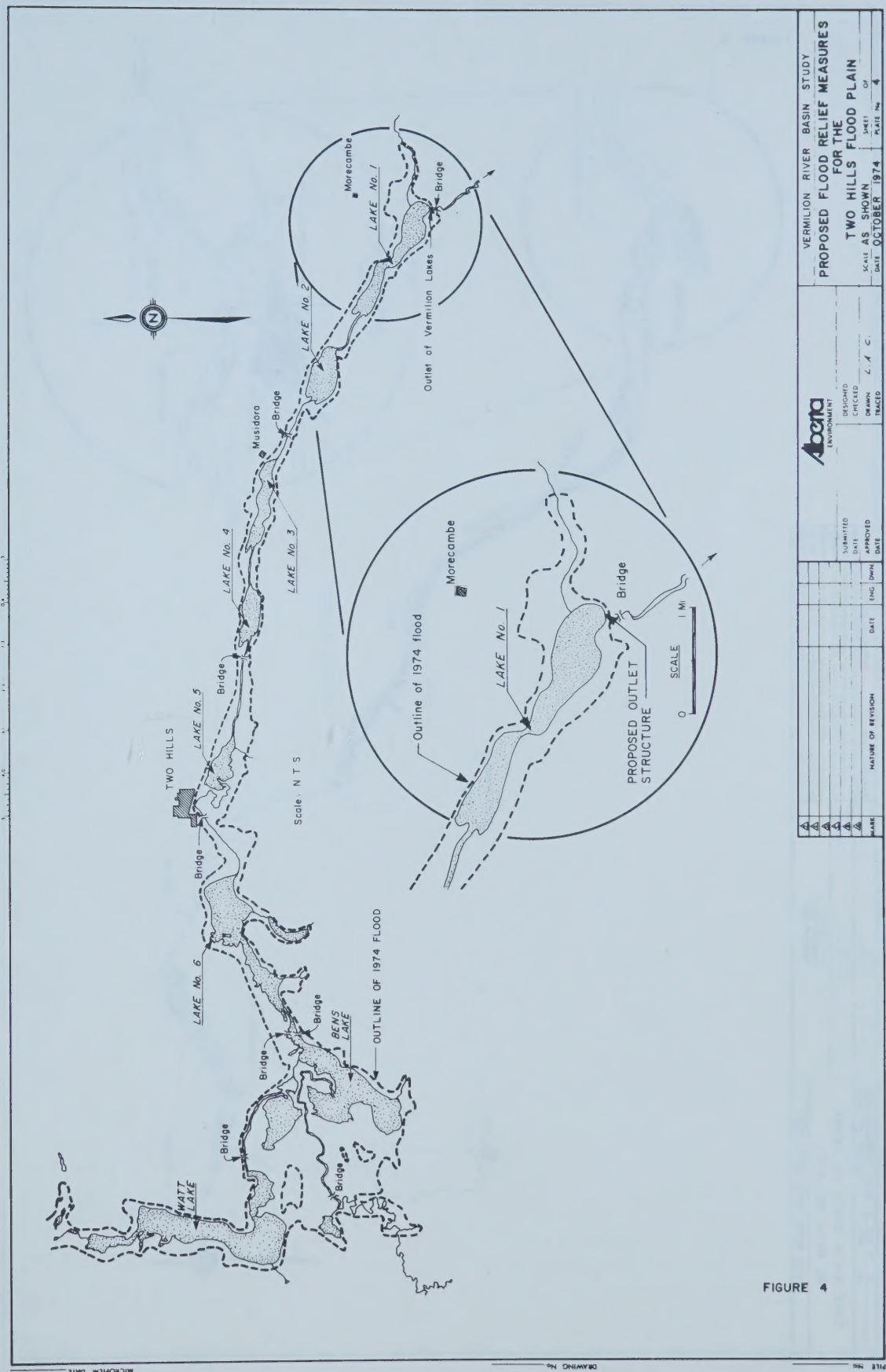
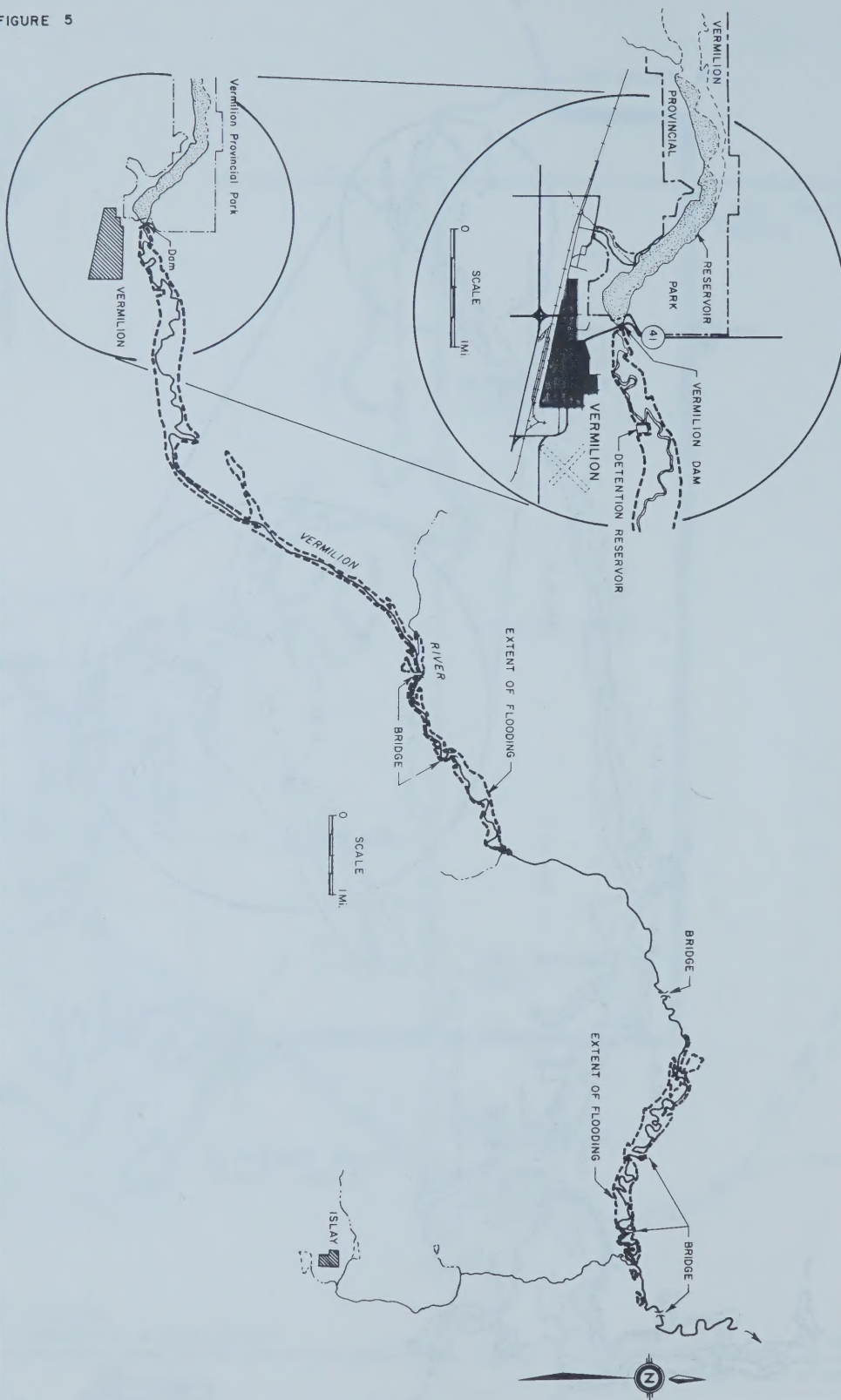


FIGURE 4

FIGURE 5

[illegible]

